



Ischemia and Infarction

INTENDED LEARNING OBJECTIVES (ILO)



By the end of this lecture the student will be able to:

- 1. List causes and effects of acute & chronic ischemia**
- 2. Differentiate between causes and pathological features of types of infarction**

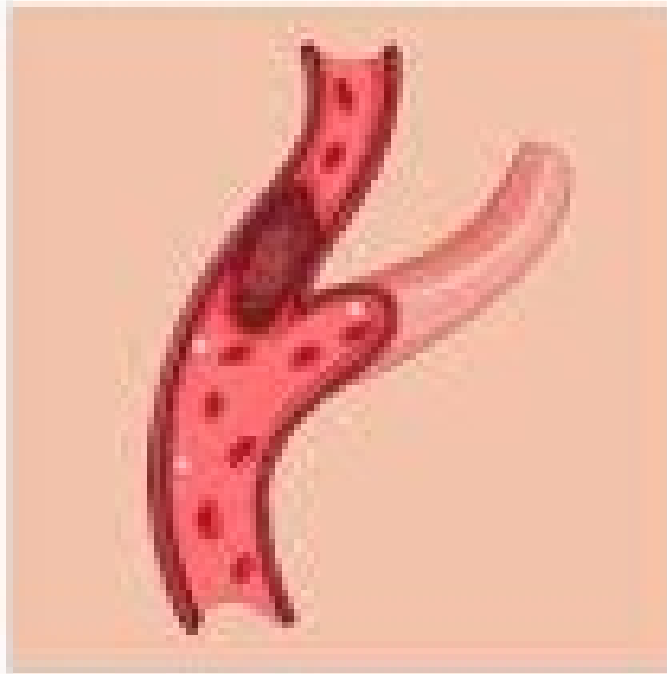
Ischemia



:Definition

.Reduction of arterial blood supply to a tissue

Two



Sudden

usion



Causes of acute ischemia



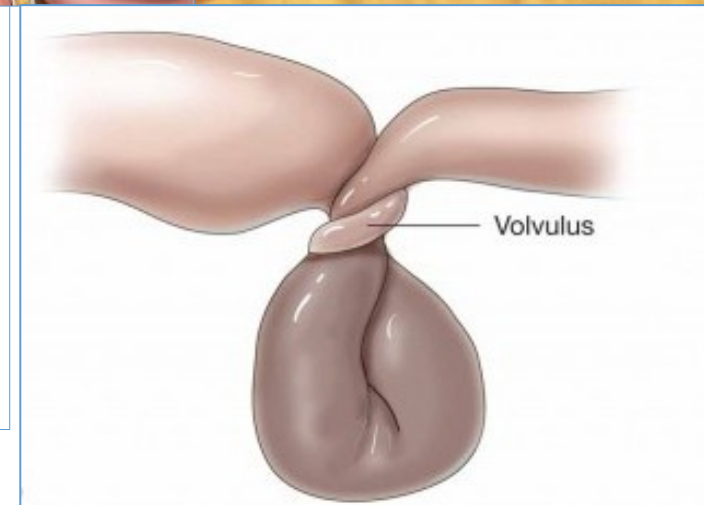
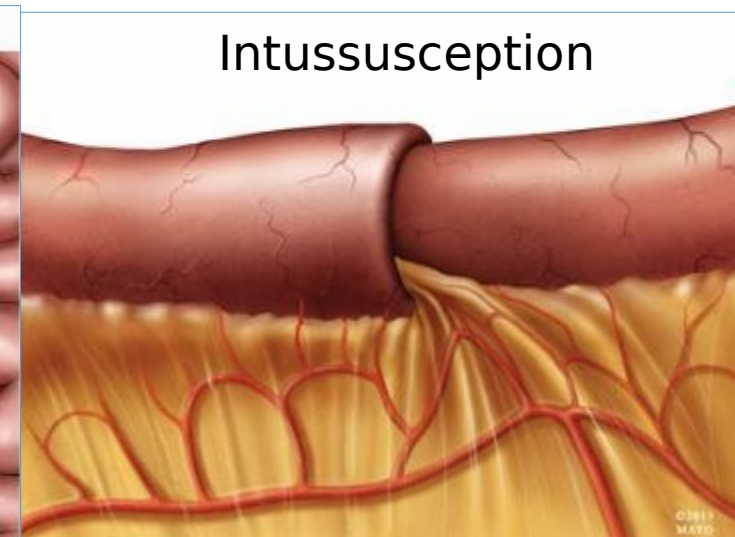
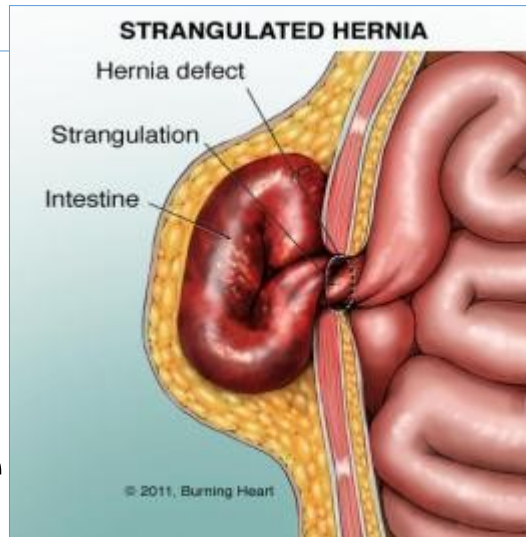
Causes of acute ischemia

1. Thrombus or embolus

2. Strangulation of vessels as occlusion of intestinal vessels

- ☐ Strangulated hernia
- ☐ Intussusception
- ☐ Volvulus

3. Surgical ligature of an artery



Causes of acute ischemia



4. Buerger's disease: Thrombangitis obliterans

❑ In heavy smoker middle aged **males**
Due to inflammatory occlusion of blood vessels

---> pain, tissue damage, and even gangrene

5. Raynaud's disease:

❑ In young **females**
❑ Due to spasmodic attacks of small arteries & arterioles due to cold or



Buerger's disease



Raynaud's disease

Causes of acute ischemia



6. Ergot poisoning:

- ❑ Severe arterial spasm as a result of vasoconstriction
- ❑ dry gangrene

7. Extensive venous obstruction

- ❑ Marked engorgement of venous

cap
arteria
flow



Ergot poisoning

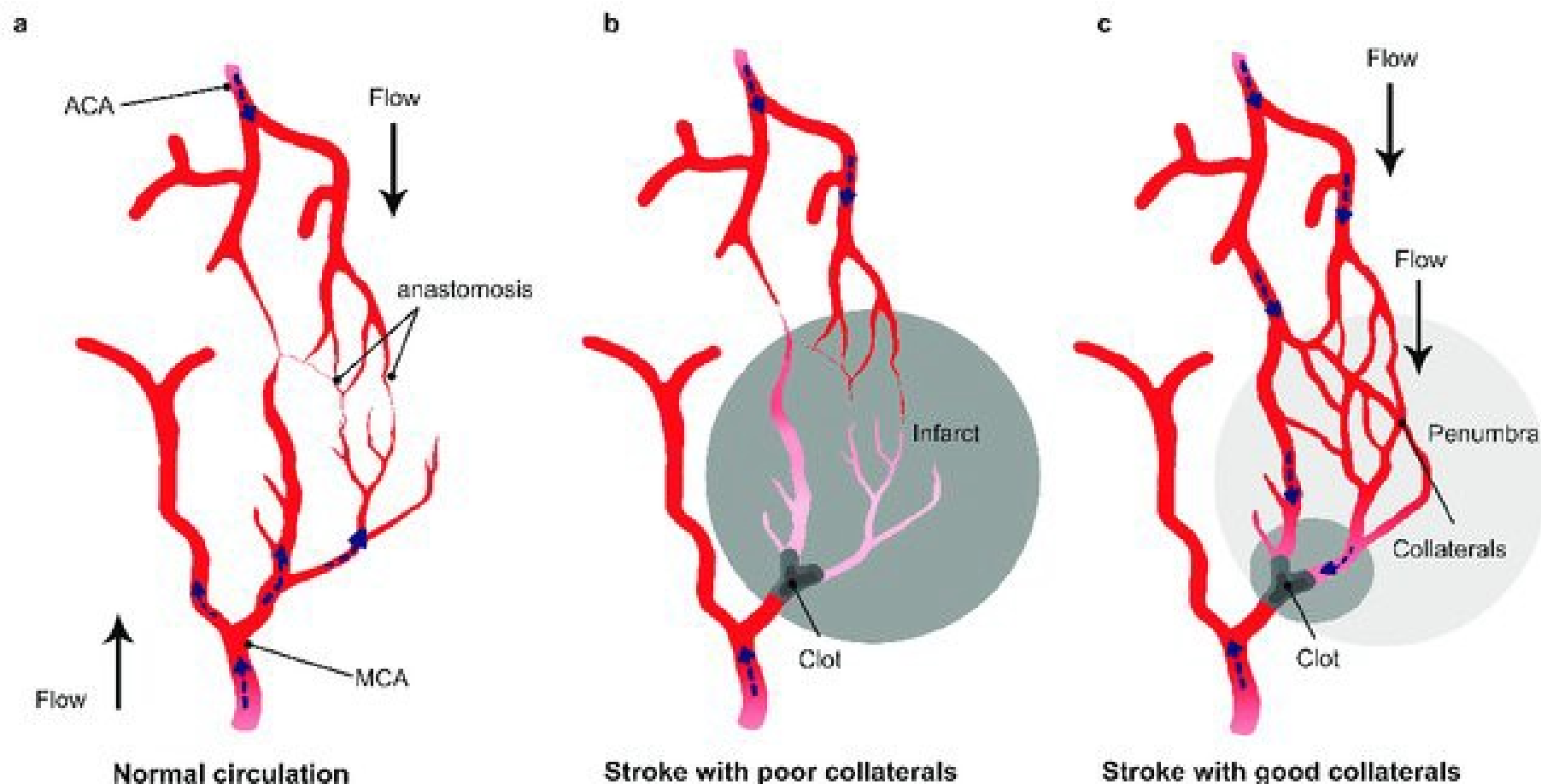


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Effects of acute ischemia



**Sudden
occlusion of
an artery
with**

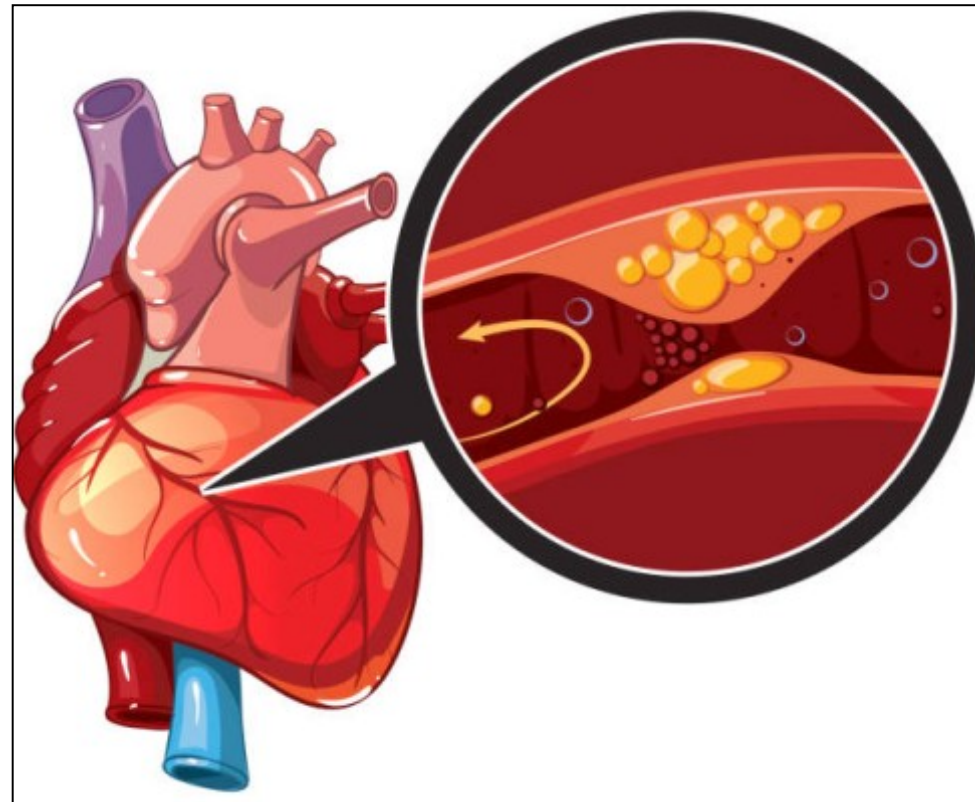


Chronic ischemia



Causes:

1. Atherosclerosis
2. Arterial compression e.g by tumours



Chronic ischemia



Effects:



Ischemia (Quiz)



List causes of acute ischemia?

Thrombus or embolus-1

Strangulation of vessels-2

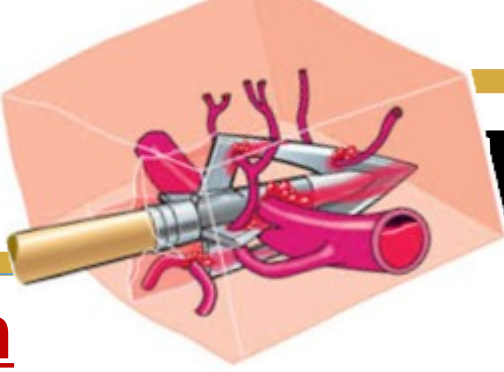
Surgical ligature of an artery-3

Buerger's disease-4

Raynaud's disease -5

Ergot poisoning -6

Extensive venous obstruction-7



Infarction



Definition

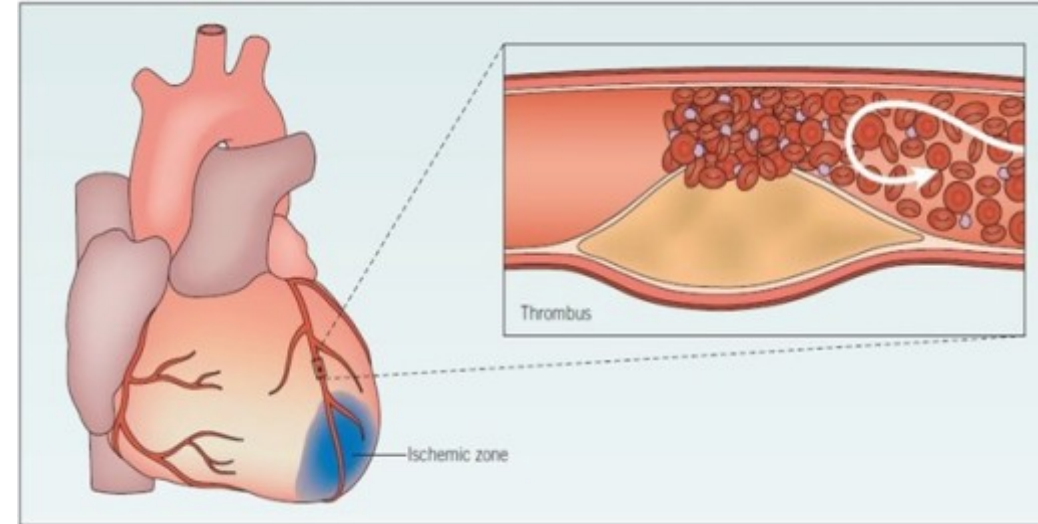
❑ An infarct is an area of ischemic necrosis caused by **sudden** occlusion of the vascular supply to the affected tissue.

Aetiology

Arterial occlusion by thrombus -1
or embolus :**99%** of cases

Less common causes include -2

- ✓ Vasospasm
- ✓ Extensive **venous** occlusion



<https://www.news-medical.net/whitepaper/20190909/Myocardial-Infarction-Cardiovascular-Research.aspx>



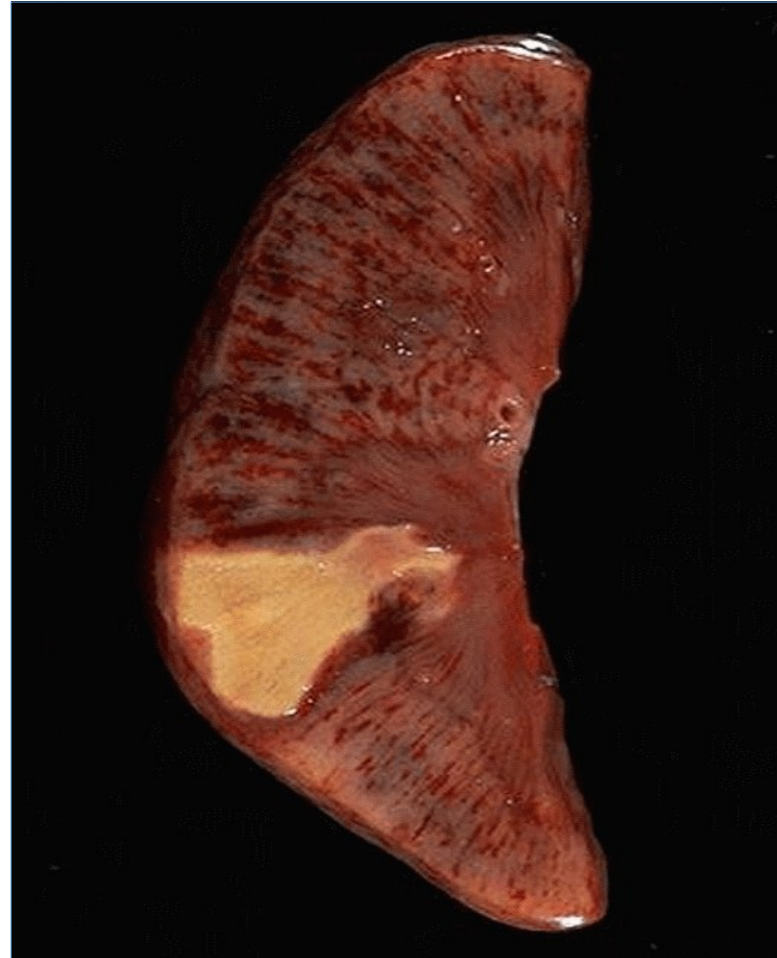
<https://www.stroke.org/en/about-stroke/types-of-stroke/ischemic-stroke-clots>

Infarction



Types of infarct

What is the difference?



Kidney



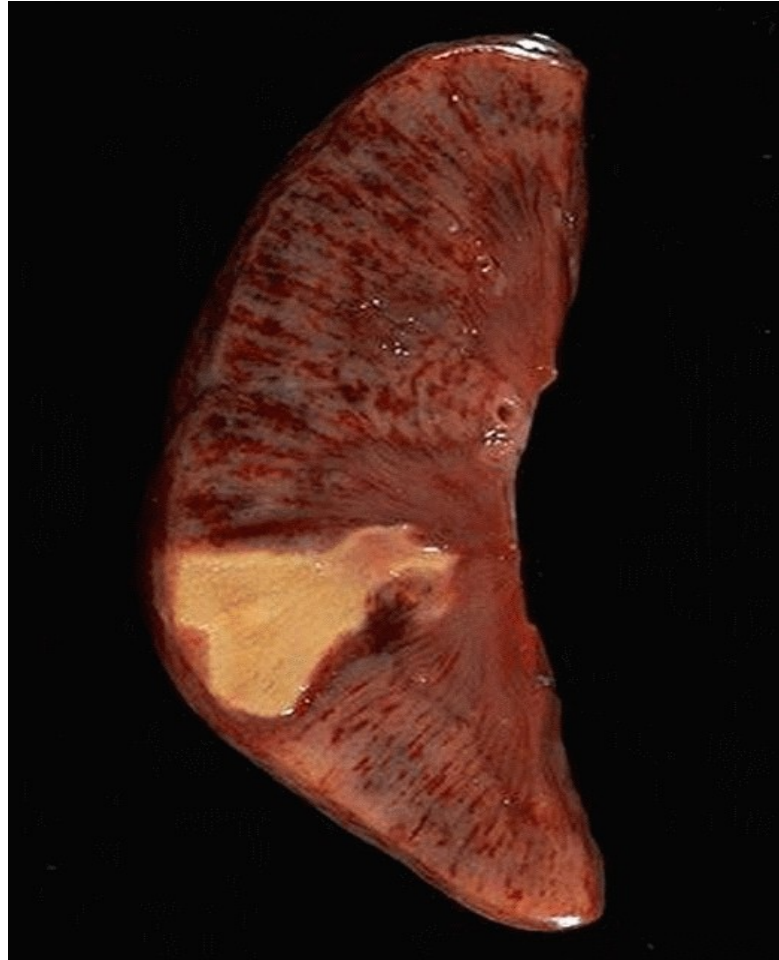
Lung

Infarction



Types of infarct

- ☐ Pale
- ☐ Red hemorrhagic



Pale (KIDNEY)

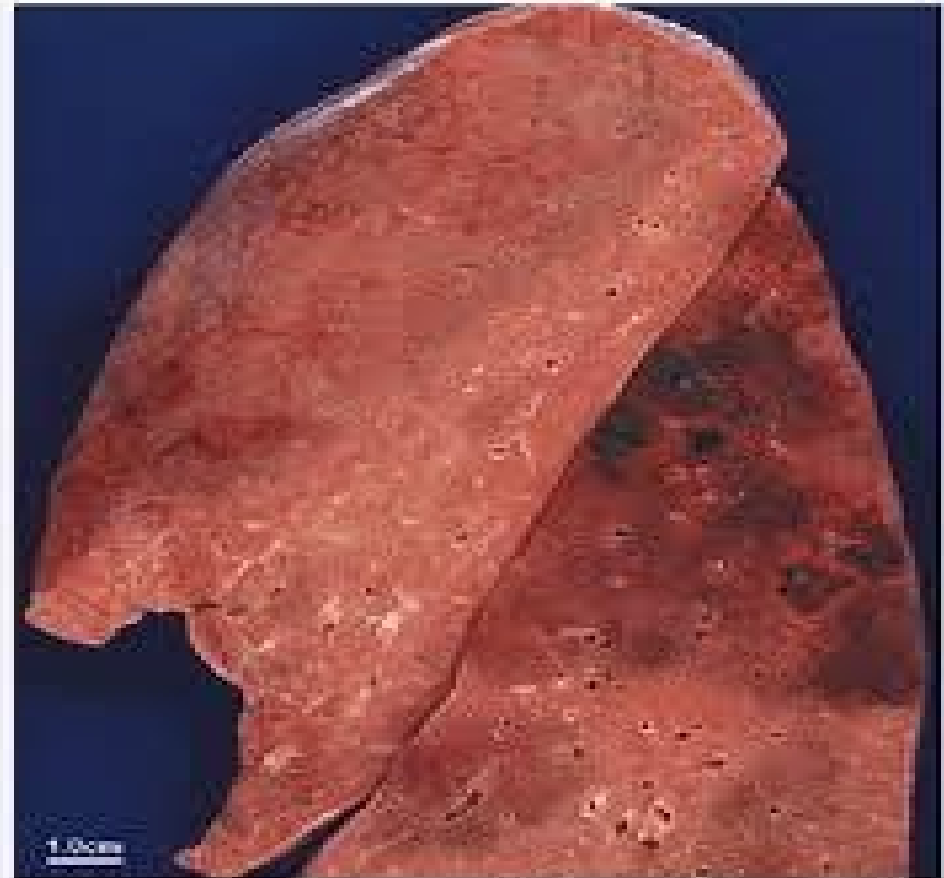
A-Pale infarcts occur with

- ☐ **Arterial** occlusion in solid organs with end arteries
- ☐ e.g heart & kidney and spleen

Types of infarction/ Red infarction



in tissues that were previously congested because of sluggish venous outflow



is
such
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Types of infarction



B-Red hemorrhagic infarcts occur in

❑ **Venous occlusions** (with or without arterial occlusion) as in

- Strangulated hernia (**intestine**)
- **Ovarian** or **testicular** torsion
- **Brain** infarction due to jugular vein thrombosis

❑ **loose tissues**

as lung and small intestine where blood can collect in infarcted zone.



Types of infarction

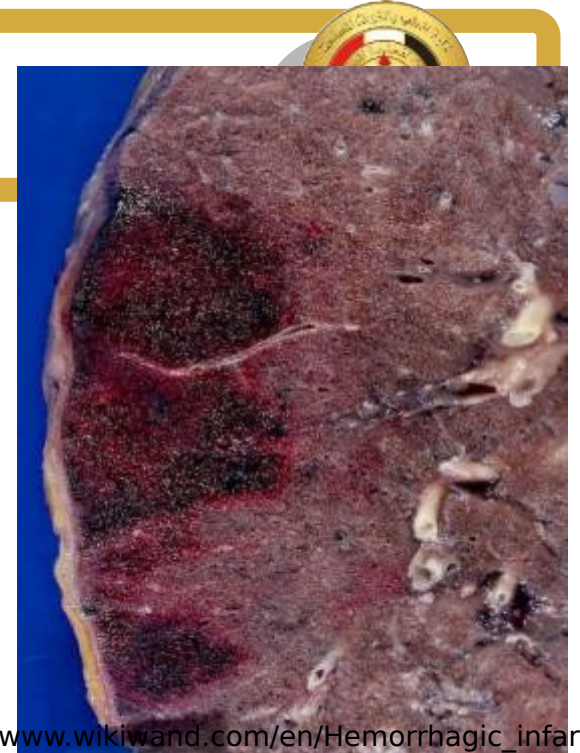
❑ Previously congested tissues

(as a consequence of sluggish venous outflow).

❑ Tissues with a dual circulation

e.g. lung, liver and small intestine
permitting blood flow from the patent
vessels into infarcted area

**(such perfusion not sufficient to rescue
the ischemic tissues).**



https://www.wikiwand.com/en/Hemorrhagic_infarct



Examples of infarction



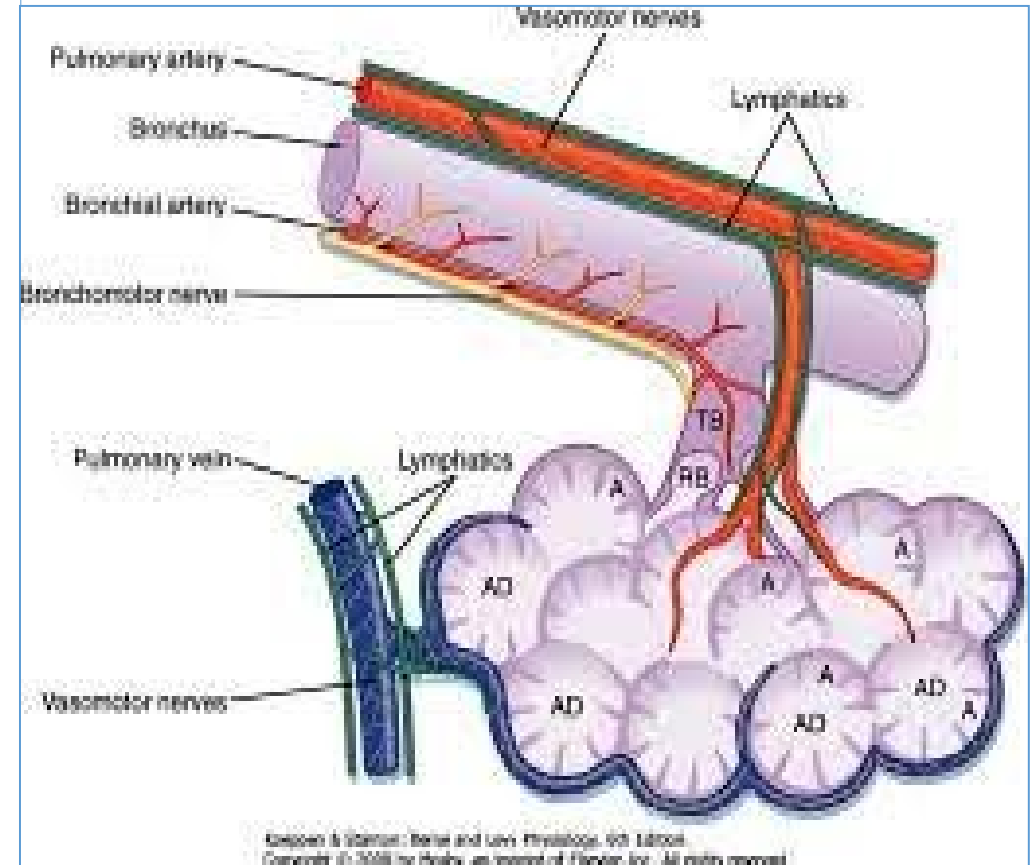
Lung infarction: hemorrhagic-1 infarction

Etiology

❑ Lung has **double blood supply** so infarction does not occur unless both pulmonary & bronchial arteries are affected.

- **Pulmonary artery occlusion** is by thrombosis or embolism

- 09/11/2024 **Inefficient bronchial blood**



Examples of infarction



N:B:

- ✓ **Lung congestion** is caused either by mitral stenosis or left ventricular failure
- ✓ These diseases that cause lung congestion simultaneously lead to **low cardiac output** → inefficient bronchial blood flow

Clinical features

- ☐ Chest pain
- ☐ Hemoptysis

Examples of infarction



Intestinal infarction: hemorrhagic-2 infarction

Aetiology

- ❑ Occlusion of mesenteric arteries by thrombus or emboli
- ❑ Intestinal strangulation

Progresses to
Gangrene due to putrefaction by intestinal bacteria

Mortality is high due to



Examples of infarction



3-Cerebral infarction

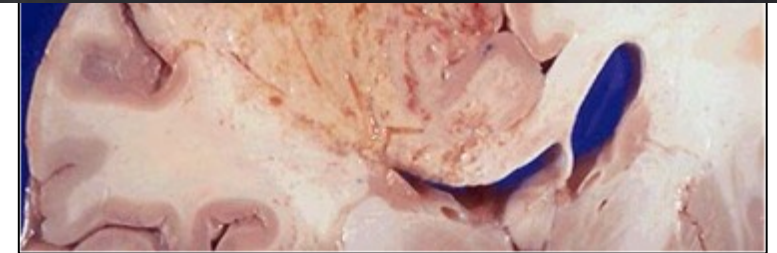
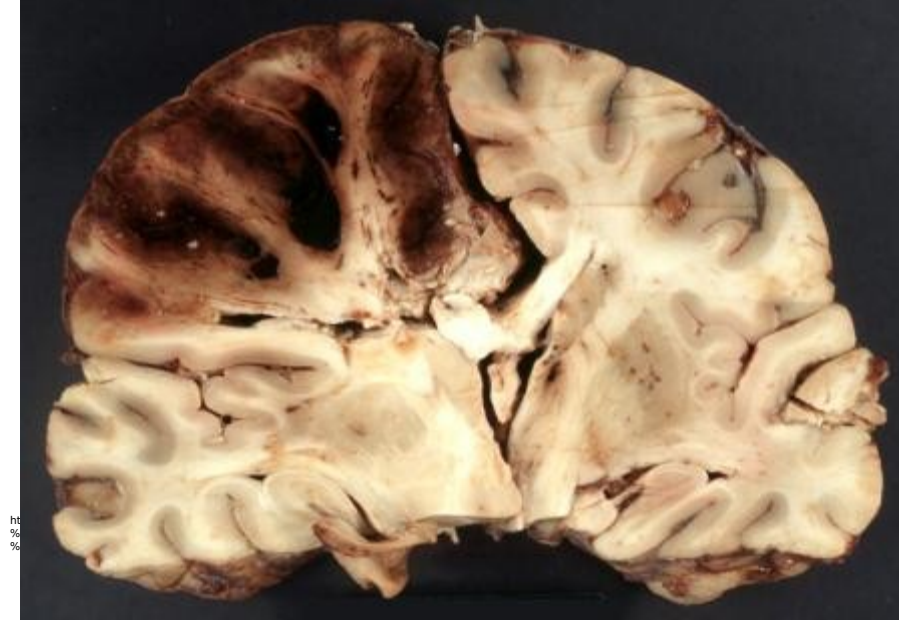
Brain infarcts may be

- ☐ **Pale** due to thrombotic or embolic arterial occlusion
- ☐ **Hemorrhagic** due to venous occlusion (jugular vein thrombosis)

Clinical effects

Vary according to site of infarction

- ☐ Hemiplegia
- ☐ Some other cases may be fatal



Pathological features of infarction



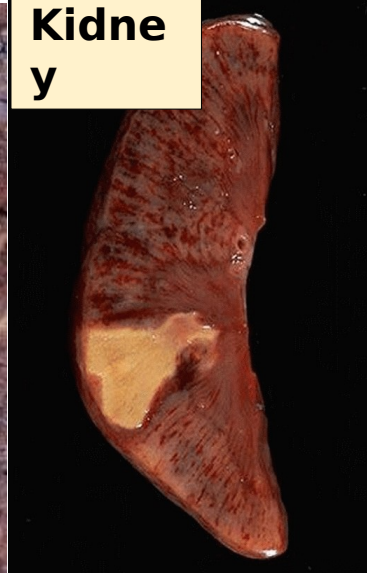
Gross features

- ❑ Pyramidal or wedge shaped infarct with
 - ✓ its **apex** at the site of vascular occlusion
 - ✓ its **base** at surface of the organ
- due to the fan shaped distribution of end arteries
- ❑ When the infarct base is a serosal surface; pleura, pericardium, peritoneum → it shows fibrinous inflammation
- ❑ Margins of the infarct are hyperemic due to inflammation
- ❑ Early, the infarct is **swollen** but later, it becomes **contracted** due to healing
- ❑ Infarcts may be **pale or hemorrhagic**

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Kidne
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Ren
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scar



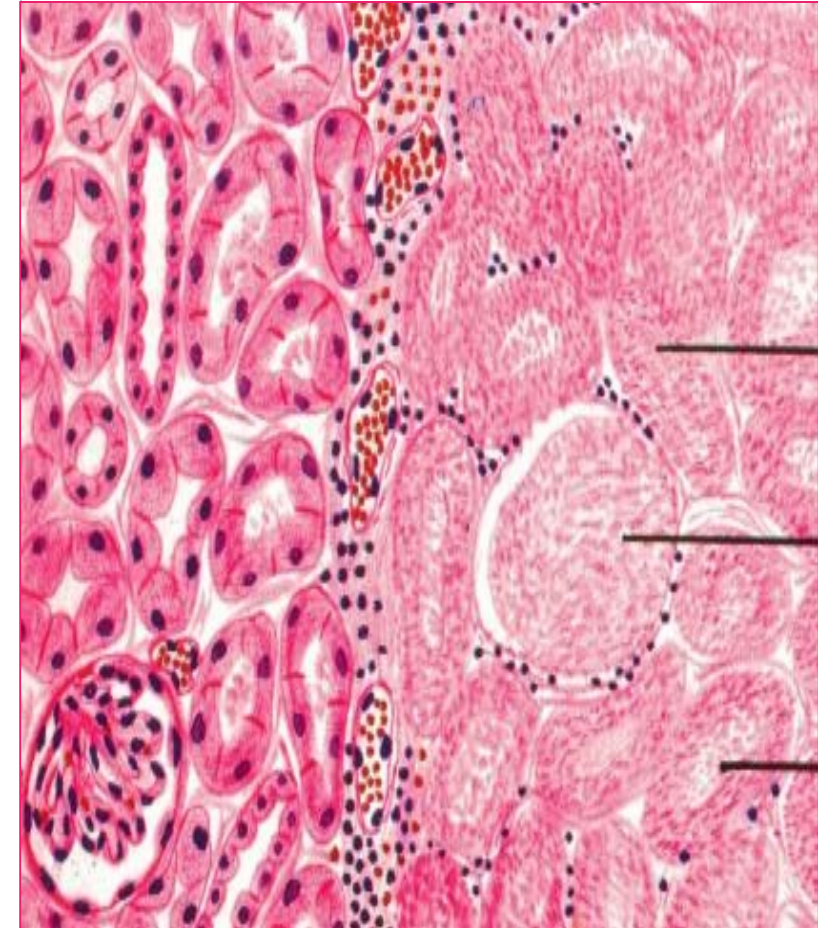
Pathological features of infarction



Microscopic features

- ❑ **Infarcts** of all organs → ischemic
Coagulative necrosis
EXCEPT CNS → liquifactive necrosis
- ❑ **The margins** of the infarct show dilated capillaries & some inflammatory cells.
- ❑ **The rest of the organ** appears normal **except** in case of lung infarction where the **lung** is congested

coagulative necrosis in kidney



Infarction (Quiz)



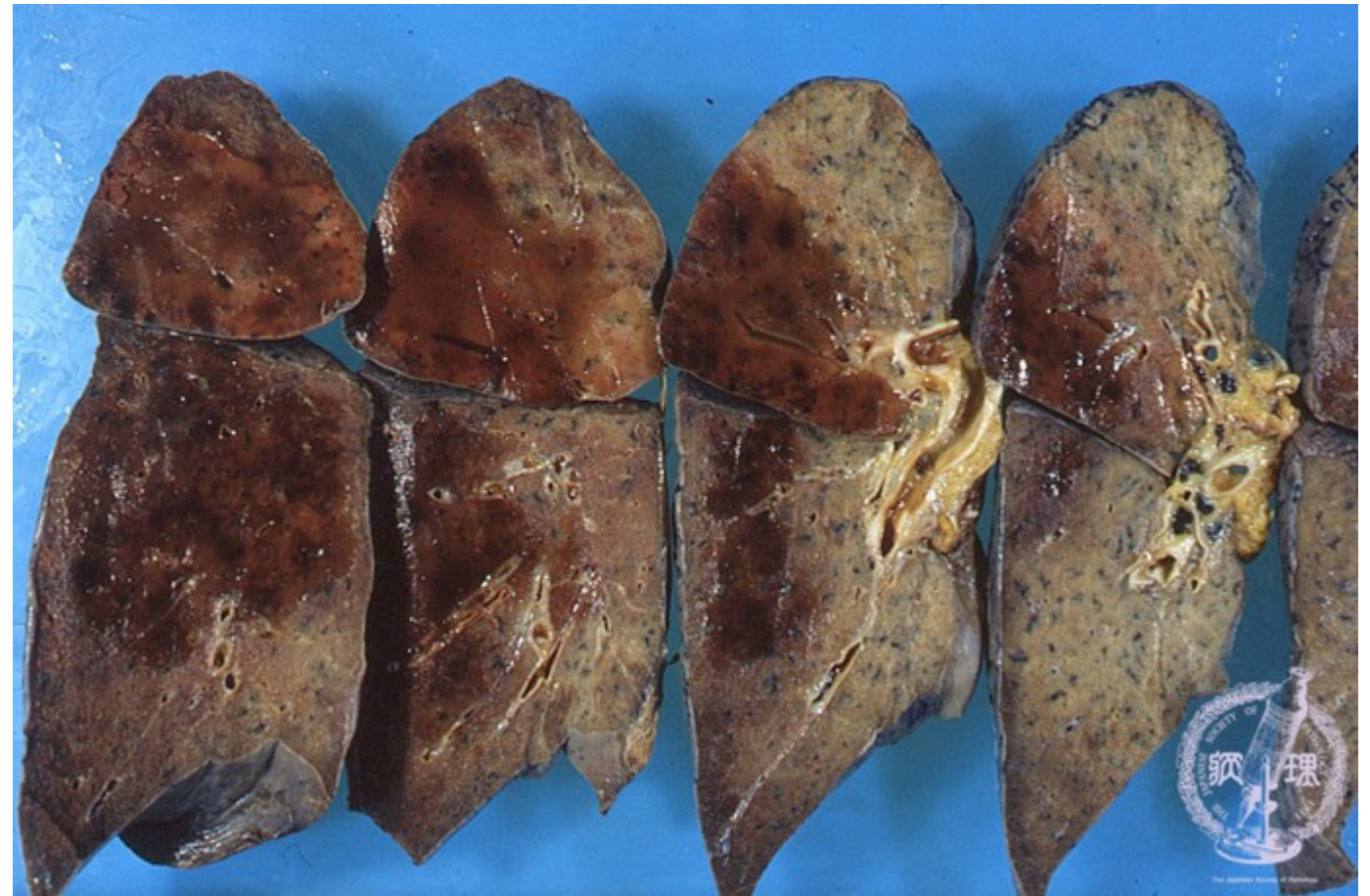
Which of the following types of infarction may be followed by gangrene

- A. Cerebral infarction**
- B. Intestinal infarction**
- C. Myocardial infarction**
- D. Renal infarction**
- E. Splenic infarction**

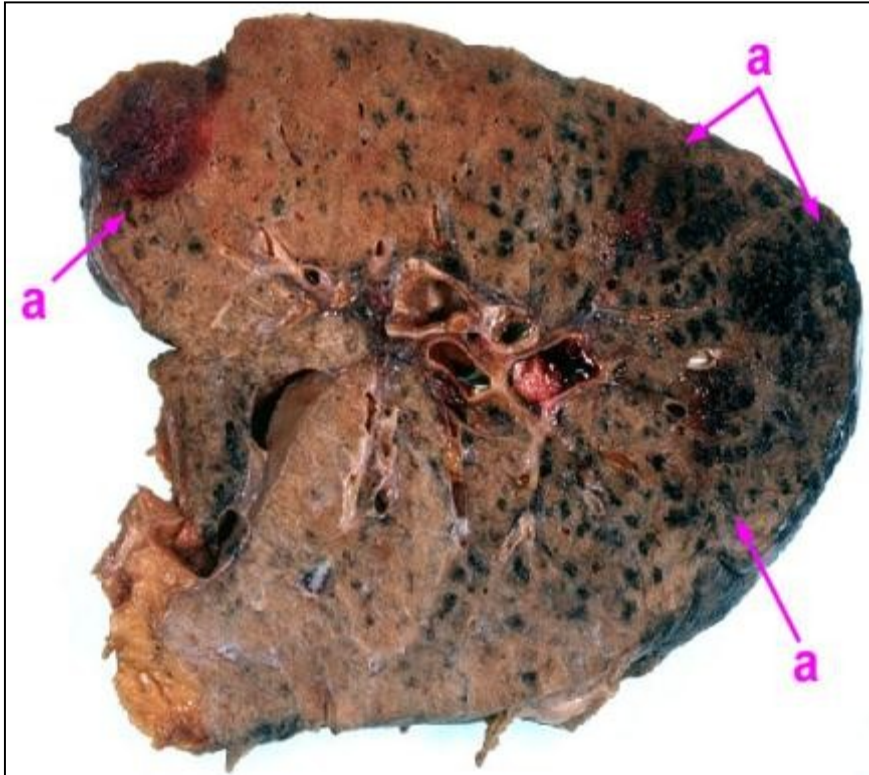
Infarction (Quiz)



What is the abnormality in this picture & what is the most common cause?



Infarction (Quiz)



- **Pulmonary infarction** with a medium-large sized embolus and obstructs a medium-sized pulmonary artery branch. If the patient has any underlying cardiovascular disease it will lead to **infarction**. This would clinically present with **haemoptysis**.

Infarction (Quiz)



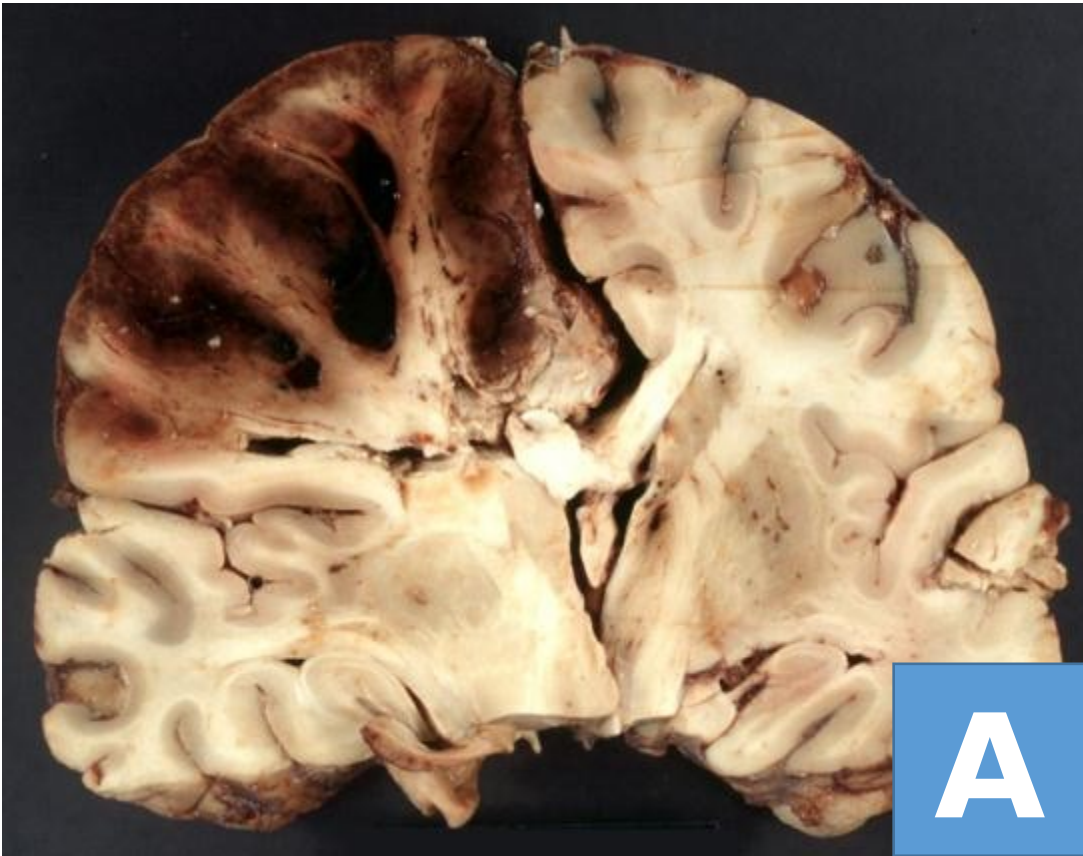
A 17-year-old married woman presented with seizures. She was confused on admission. She had headache persistent for the last 2 weeks. She vomited intermittently for last 7 days. Past medical, and family histories were unremarkable. She did not experience neck trauma or repetitive neck compressions. She was on oral contraceptives.

CT scan of the brain and has shown a large brown area in the left frontal lobe antero-inferiorly, with minimal oedema of the surrounding brain parenchyma

Infarction (Quiz)



For this clinical history which of the following is the most closely associated gross pathologic finding? Justify???



Infarction (Quiz)



There is a specific type of necrosis that occurs in the brain after an infarction. What is the name of this necrosis?





- ***Key points:*** Acute ischemia results from sudden complete arterial occlusion, while chronic ischemia results from gradual incomplete arterial occlusion
- Infarction may be pale or red
- Pale infarction occurs due arterial occlusion in solid organs with end arteries
- Red infarction occurs in previously congested organs, loose tissues, with venous occlusion and tissues with dual blood supply
- The infarct is pyramidal or wedge shaped with base

Suggested Textbooks



1. Robbins basic pathology; 10th edition from page 114 to 119
2. <https://webpath.med.utah.edu/webpath.html>

